

BROOKER CREEK PRESERVE INCIDENT ACTION PLAN

STRATEGIC ANALYSIS OF COMMUNITY RISK REDUCTION

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ABSTRACT

East Lake Fire & Rescue has aggressively suppressed all fires within its jurisdiction. In 1991 the Brooker Creek Preserve was established within the boundaries of the Fire Control District. In the case of structural fires aggressive suppression is still valid in order to protect life and property. The problem was, this approach to wildland fires in the Preserve caused dangerous buildup of fuels and an imbalance in the ecology.

The purpose of this Applied Research Project was to create a pre-fire plan for use on future fires at the Brooker Creek Preserve that will incorporate the goals of the Fire Management Plan. The methods utilized were historical and action research in order to answer the following questions:

1. What is the difference between a Fire Management Plan and a Pre-fire Plan?
2. What effects did weather play on the Brooker Creek fire?
3. What is prescribed burning and what are the benefits and risks?
4. What is the cost of combating fires in the wildland?
5. What tactics, strategies, and technologies are available to combat wildland fires?

The procedures employed were a review of the development of Florida's ecology and the fire history of the Preserve. Technical information was gathered from the Florida Division of Forestry, staff of the Brooker Creek Preserve, and fire officials throughout the State of Florida. Fire data used for analysis was obtained from the Brooker Creek fire of September 1997.

The development of a pre-fire plan required an on-site survey of the Brooker Creek Preserve.

The components of the Incident Command System were studied and analyzed and resulted in the creation of an Incident Action Plan to be used on future fires on the Preserve.

The recommendation resulting from this research was an Incident Action Plan that if approved by the top management officials of the fire service and the Brooker Creek Preserve, would allow wild fires to burn as if they were planned prescribed burns under preferred weather conditions.



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INTRODUCTION

The State of Florida created the East Lake Tarpon Fire Control District in 1973. As part of its responsibility, East Lake Fire & Rescue (ELF&R), was to aggressively suppress all fires that occurred within its jurisdiction. Wild fires and structural fires were handled in the same way. In 1991, the Brooker Creek Preserve was established within the boundaries of the Fire Control District. The purpose of the Brooker Creek Preserve was to allow the enjoyment of nature by the community and preserve the ecology of the area. The policy of aggressive suppression of all wildfires on the preserve was in direct conflict with the goals of the Fire Management Plan of the Brooker Creek Preserve, causing excessive fuel loading and damage to the environment.

The purpose of this Applied Research Project was to create a pre-fire plan for use on future fires at the Brooker Creek Preserve that will incorporate the goals of the Fire Management Plan of the Preserve. The "let it burn" policy was explored as a replacement for the aggressive fire suppression strategy of the past. The development of a pre-fire plan was an Incident Action Plan for combating fires on the Brooker Creek Preserve.

Scientific research supported the theory that wildfires were an important factor in ecology and the evolution of plant communities and native vegetation, and were required for maintenance of environmental balance. The Florida Division of Forestry and Pinellas County Department of Environmental Management recognized the importance of fire ecology. The Brooker Creek Preserve included the use of prescriptive burning in its Fire Management Plan.

The "let it burn" philosophy incorporates the Fire Management Plan into the Incident Action

Plan; in that future fires on the Preserve were contingent upon weather conditions before being allowed to burn as if a prescribed wildland fire.

This Applied Research Project included a case study of the Brooker Creek Preserve fire of September 1997. This fire lasted four days, consumed five hundred acres, and cost more than \$12,000 to suppress. The property damage resulting from the fire was minimal, while the long term benefits to the local ecology were significant. The fire was aggressively fought using traditional tactics and strategies. Because of the large size of the fire, this strategy failed. A "let it burn" policy was then implemented to contain the fire, and this proved successful with help from Mother Nature.

This Applied Research Project used a historical and action research methodology.

The research questions to be answered were:

1. What is the difference between a Fire Management Plan and a Pre-fire Plan?
2. What effect did weather play on the Brooker Creek fire?
3. What is prescribed burning and what are the benefits and risks?
4. What is the cost of combating fires in the wildland?
5. What tactics, strategies, and technologies are available to combat wildland fire?

BACKGROUND AND SIGNIFICANCE

Brooker Creek Preserve

The Brooker Creek Preserve (BCP) was formed from the Pinellas County's Comprehensive Plan mandated by the state of Florida in the late 1980's. Pinellas County owns the majority of the preserve's property; certain sections belong to the Southwest Florida Water Management District, Eldridge-Wilde Well Fields, Florida Power Corporation, and others jointly owned with the state through P-2000, a preservation program (See Map 1). In 1991, the pieces of property were formulated into the Brooker Creek Preserve, which is managed by Pinellas County Environmental Management. With more than 8,500 acres, the preserve is the largest undeveloped piece of land in Pinellas County, which is the most densely populated county in the State of Florida.

The primary goals of the Preserve include:

Preserving the natural water resource benefits, particularly flood storage, now provided by the Brooker Creek floodplain; maintaining the natural groundwater recharge characteristics of northeast Pinellas County; protecting the watershed of Lake Tarpon; the conservation and restoration of habitat and wildlife native to the County and to west-central Florida; providing an area to County residents that would be suitable for passive recreational activities; and developing a setting for learning about natural resources. The intent of these goals - the Mission of the Preserve - is to create the opportunity for County residents to experience, understand, and enjoy native Florida (St. Clair et al, 1993, pg. 1)

The BCP is rectangular in shape and measures approximately eight miles long and

one and one-half miles wide. Stretching north to the Pasco County line and to the city limits of Oldsmar to the south, and nestled between the Hillsborough County line to the east and the various housing developments from Crescent Oaks to East Lake Woodlands on the west, the 8,500 acre preserve is an island of wilderness in a rapidly changing sea of urbanization (Map 1).

Wildland fires that occurred on the BCP prior to 1997 were aggressively suppressed by East Lake Fire & Rescue (ELF&R) and the Florida Division of Forestry (FDOF). In 1997, firefighting tactics and strategies changed from suppressing all fire, to a "let it burn" strategy, which incorporated the goals and mission of the Preserve.

In July 1997, the Preserve staff, with the assistance of the FDOF, ELF&R, and the Oldsmar Fire Department (OFD), executed the first prescribed burn for the BCP. The fire was conducted under the fire management plan for BCP. The primary goal of prescribed burns is the reduction of heavy fuel loads that have been building over the decades. Approximately 30 acres of Cogon grass have been treated through prescribed fires. An additional 900 acres have been burned by wildfires.

Brooker Creek Fire (A Case Study)

On September 17, 1997, a thunderstorm raced throughout North Pinellas County. Lightning ignited a fire east of the Ridgemoor subdivision. At 15:15 a District Chief from ELF&R reported heavy smoke showing in the area of the BCP, and called for a "Code 10" brush fire response. ELF&R responded with two brush units, one engine and a District Chief.

Command was established upon arrival at the scene. A "working brush fire" activation was

initiated which notified the staff of ELF&R, FDOF, and the staff of the BCP that there was a fire on the preserve.

The initial attack forces located two fires in fire grid 102B (See Map 2). The first fire was reported to be in the area of the Coventry and Ridgemoor subdivisions. The second fire was deeper in the BCP and was not a danger to any structures.

Additional units were called in under a mutual aid agreement to assist with the extinguishment of the fires. The aggressive attack of the fire at Coventry was quickly under control. The second fire was reported to be 100 x 100 yds. in size, and traveling west by northwest at 1 - 2 MPH, in tall tree coverage, heavy palmetto and gallbary ground cover. Due to the limited access to the fire, a Pinellas County Sheriff's helicopter with a Bambi bucket was called in to make water drops, and the FDOF had two tractors in operation. The combined efforts of the Hillsborough County, Palm Harbor, Safety Harbor, Oldsmar and East Lake Fire Departments could not bring this fire under control. Fire operations for the first day were suspended due to the fact that no structures were in danger.

During the second day of the fire, FDOF requested the Pinellas County Sheriff's helicopter to do an aerial view of the fire, and it was reported that the fire burned about 240 acres. A unified command was set up and decided to use a counter fire to contain the fire. At 15:54, FDOF reported that the fire jumped the fire break in two places and that a spot fire started about one half mile from the original fire. Once again additional units were called in to combat the wildfire. The fire was contained for the night, and fire operations continued in the morning.

The third day of the fire, it was reported that the size of the fire was approximately 475 - 500

acres. The fire prompted more than 200 phone calls to the Pinellas County's 911 dispatch center. The Pinellas County Air Quality division issued an air pollution advisory: Due to smoke from the brush fire - "People with asthma and other breathing difficulties should remain indoors". The fire was still burning but was contained and units were cleaning up the remaining hot spots. A call for Class A foam was requested but was not used. After another full day's work the fire was still not out.

The fourth day of the fire, operations were discontinued at 13:00. The fire was contained, but continued to smolder. Due to the large size of the fire, the only way to completely extinguish the remaining areas was with a good rain. Five days later another storm dumped 7.5 inches of rain, and that did the job. It is ironic that Mother Nature started this fire, and ultimately ended it.

Summary report: total time of this incident was 37 hours over a span of four days. The fire required the assistance of four local fire departments and units from two other counties. The FDOF and two county divisions were involved in the incident. This was the largest fire in the BCP's history, and the longest running incident for the ELF&R in the 90's.

After reviewing the Brooker Creek fire, this writer volunteered to prepare a pre-fire plan to satisfy the Applied Research Project requirement associated with the Executive Fire Officer Program at the National Fire Academy. This research relates to the strategic planning unit of the Strategic Analysis of Community Risk Reduction Course. Strategic analysis is the analysis of the planning process. The focus of the strategy is planning. The planning process is the means to the end, which is action in the form of an Incident Action Plan to be used for future fires at the BCP

LITERATURE REVIEW

The purpose of this literature review was to establish a foundation for this project. This includes studying the concepts of a pre-fire plan, and its implementation in an Incident Action Plan for use in combating future fires on the Brooker Creek Preserve.

Planning for Wildland Fires

When a fire department is acquainted with the potential of a fire before it occurs, that department has an advantage over the fire, provided that it makes preparations...the requirements for combating a fire should be studied, and plans should be prepared...pre-fire planning will identify major problems, prescribe what is needed to meet them, and provide for meeting such needs (Clark, 1991, pg. 285).

The typical fire department's focus in developing preplans is for man-made structures, i.e. buildings, fuel refineries, hospitals, or large assembly areas. Due to restrictions in staffing levels, most of the efforts are toward high potential, expensive building improvements. This leaves little time and energy for developing preplans for wildland areas. In addition, wildland areas are under the jurisdiction of city, county or state agencies that have fire management plans in place, which takes the focus off the need to develop a preplan.

John T. Koehler, the District Manager of the Florida Division of Forestry in Orlando, Florida described the differences between a fire management plan and a pre-fire plan. A fire management plan is proactive whereas a pre-fire plan is reactive. The proactive approach uses fire in the ecology to restore and promote plant growth, and to reduce the dangerous buildup of fuel levels with the use of

prescribed fires, thereby reducing the size and intensity of wildfires. The reactive approach waits for a wildfire to occur for the plan to be implemented (Koehler, personal communication, October 15, 1997).

A comparison between the strategies of a Fire Management Plan designed by the managers of a wildland area, and the tactics of a traditional fire department pre-fire plan is like the difference between watching the movie Bambi as to watching the movie Backdraft . "The most difficult concept for structural firefighters to accept is that forests and wildlands are supposed to burn" (Dowd, 1996, p. 8). Aggressive firefighting tactics are not appropriate in the wild because this prevents fire's natural role in the ecology of the wildlands.

The forces of nature add to the complexity of the development of wildland fire plans. The elements of weather, temperature and wind must be taken into consideration. These may not be familiar to the suburban firefighter, but are critical in the efficiency of the plans.

A great deal of wildland firefighting is done by the rural to semi-rural and suburban firefighters. Structural firefighters are going to be called upon with increasing frequency to fight these wildland fires. The structural fire services really need to take a close look at this and prepare, train and equip their people for wildfires (Winston, 1996, pg. 42).

In dealing with wildfires, firefighters must be "more flexible to handle a fast-moving incident... unlike structural preplans, which give firefighters specific information on the buildings they are responding to, wildland plans are dynamic allowing for variables in weather" (Bisbee, 1993, pg. 51).

THE HISTORY AND ECOLOGY OF FIRE

The southeast is the lightning capital of North America (Fletcher, Personal Communication, October 8, 1997). More thunderstorms and lightning strikes are reported here than anywhere else on the continent, especially during the late spring and early summer. With storms and lightning comes fire.

For many thousands of years, lightning set fires burned through the woods as freely as barriers like rivers would permit. When driven flames moved through every few years, they were relatively mild and could sweep the forest floor without eliminating either pines or ground cover plants (Cerulean, 1991).

"Humans have probably used and kept fire for more than 500,000 years, though actual capability to produce fire was probably learned only in the last 20,000 years" (Johnston, 1970, pg. 78).

After Indians settled this land, they soon added their own fires. They would burn intentionally to flush game and clear brush around their villages. The Europeans continued the tradition to improve conditions for their cattle.

Around the 1900's the government became concerned about wide-spread burning. People thought fire hampered the regeneration of pine lands and harmed wildlife. "In response to this, educational programs such as, "Dixie Ranger," traveled the hills of Appalachia spreading fire prevention" (Sampson, 1996). In 1945, a poster was circulated featuring Smokey Bear. "The Smokey Bear campaign has been one of the most effective campaigns in history. It has influenced public opinion favorably in combating a serious national wildfire problem" (U. S. Government Printing Office, 1978).

For hundreds of years, wildlands in this country have regularly gone up in flames.

Sometimes the causes are natural, with lightning, winds, and drought contributing to the blazes. Because lightning fires are and have always been a common and predictable aspect of Florida's ecology, our natural areas have evolved around them. Although we may view fire as a destructive influence, it is a necessary and life giving force in Florida. Fire is an essential component for our natural areas. Fire produces many ecological benefits. It frequently promotes flowering and fruit production. "Plants such as blueberries set their largest fruit crops in the summer following a burn. Wiregrass, the dry component of our pineland understories, will not even flower if not burned during the summer months" (Huegel, 1996, p. 11). After the Brooker Creek fire described in the case study, "The result: Brilliant wildflowers have emerged where underbrush once covered them, and rare wildlife have made homes there" (Gross, 1998, p. 8). Fire elevates the availability of various necessary plant nutrients and raises surface soil pH. Fertile soils promote plant growth and new growth increases the nutritional quality available to the various browsing animals, such as white-tailed deer and rabbits. Areas that do not burn on a natural regiment can not support the same numbers of animals nor animals of optimum weight or size. " By eliminating fire from our natural communities we have greatly upset the ecological balance, and we have created conditions favorable for dangerous wildfires" (Huegel, 1996, p. 11).

This is where prescribed burning comes in. Prescribed burning is distinguished from a wildfire in that a wildfire, usually ignited by lightning, is unpredictable in time and place. In contrast, a prescribed burn is carefully planned and ignited at will. The option to burn allows for planned structure protection as well as the added benefit of eliminating excess fuels that would be hazardous should a wildfire break out. Brenner defined prescribed burning as, "the controlled application of fire to existing naturally

occurring fuels under specified environmental conditions, following appropriate precautionary measures, which allows the fire to be confined to a predetermined area and accomplishes the planned land management objectives" (Brenner, 1992, p. 27).

There are several objectives for using prescribed fire: (a) to reduce hazardous fuels; prescribed fire is the most practical way to reduce dangerous accumulations of combustible fuels, (b) improve wildlife habitat, (c) manage competing vegetation; unwanted species may crowd out shade tolerant hardwoods; the judicious use of prescribed fires can be managed to limit competition with desired species, (d) control insects and diseases; prescribed burning costs much less than traditional chemical control methods, (e) improve access; hikers and other users also benefit from easier travel and increased visibility and accessibility (Wade, 1988, p. 3-7).

Negative Effects of Fire on Air Quality

Prescribed fires aren't always beneficial. When conditions are wrong, prescribed fire can impair visibility creating serious highway traffic hazards and public nuisance. Proper planning and execution are necessary to minimize any detrimental effects to air quality. Smoke from prescribed fires, as well as wildfires, are highly visible, which effects public opinion, as well as posing a health hazard. "Smoke from wildfires can be a mixture of CO, lead, sulfur, plant toxins, aldehydes, particulates, even ozone and organic acids" (Winston, 1993, p. 38). This combination is just as serious a health hazard as structural smoke. "An incident from the 1987 California fire season serves as an illustration. During one wildfire, approximately 6,000 persons were evacuated due to an inversion layer of smoke equivalent to almost 5 times an official smog health hazard warning" (Sullivan, 1989, p. 5). One of the elements of wildfire is

ozone which acts directly on the mucous membrane causing impaired respiratory functions. According to Peter Hoessling, of the Pinellas County Air Quality Division, "particularly sensitive groups include young children, the elderly, persons with respiratory ailments and individuals who exercise vigorously. Symptoms may include, sore throat, chest pains, coughing and headaches" (Hoessling, personal communication, November 21, 1997).

As well as the health hazard posed to the general public in the vicinity of the fire, the elements of the smoke can be particularly harmful to the firefighters. The harder the firefighters are physically working to contain the fire, the more toxic elements they inhale.

Two of the most common pollutants wildland firefighters encounter are particulates and carbon monoxide. Particulates irritate the body's membranes and cause allergic and asthmatic reactions in susceptible individuals. Carbon monoxide, a colorless, odorless gas produced during incomplete combustion, has a high affinity for hemoglobin, thereby replacing oxygen in the blood (Putt, 1992, p. 61).

Fire Weather

The wildland fire effects the community in many ways. One of the most critical elements of a wildfire is weather and its effect on smoke management. "In fact, weather is probably the most important factor of fire behavior that the firefighter needs to understand in order to combat the wildland fire" (Queen, 1992, p. 24). Weather consists of elements such as temperature, thunderstorms, general winds, and atmospheric dispersion. A complete explanation of fire weather is beyond the scope of this paper.

A key element in the Brooker Creek fire was atmospheric dispersion. "Dispersion refers to those processes within the atmosphere which mix and transport pollutants away from a source...atmospheric dispersion mainly depends on three characteristics of the atmosphere: atmospheric stability, mixing height, and transport wind speeds" (Matthews, et al. 1985, p. 12).

Atmospheric stability is the resistance of the atmosphere to vertical motion. When the atmosphere is stable, temperature decreases slowly as altitude increases. Under very stable conditions, inversions may develop in which temperature actually increases with height. The distance from the ground to the base of this inversion layer is called the mixing height. The mixing layer is defined as the layer of air within which vigorous mixing of smoke and other pollutants takes place. The average windspeed throughout the mixing layer is called the transport windspeed. "Mixing heights above 1,700 feet and transport windspeeds above 9 mph are desirable for good smoke dispersion" (Wade, 1989, p. 15). General pressure patterns have a pronounced effect on transport winds and stability characteristics of the atmosphere and affect how well the smoke will disperse. See dispersion index in APPENDIX A. As weather patterns change, so does smoke behavior. "Some sort of system needs to be in place to monitor fire weather. Most of the time state or federal wildland agencies monitor fire weather forecasts" (Bisbee, 1993, p. 49).

The Cost of Fire

"Prescribed fire is the most economical and environmentally sound approach to managing large blocks of fuel" (Franklin, 1996, p. 25). In contrast, the cost of suppressing wildfires is very expensive in terms of manual labor, mechanical equipment and aircraft. According to Ken Yancey, the Nature Park

Supervisor for Boyd Hill Nature Park,

A controlled burn was conducted on March 5, 1993 to reduce build up of vegetative fuels on a 42 acre block of the Boyd Hill Nature Park within the city of St. Petersburg. Due to the planning and containment of the controlled burn, the implementation costs were reduced. The burn lasted approximately 10 hours at a cost of \$3,700 (Yancey, personal communication, October 24, 1997).

A summary of the direct costs is found in APPENDIX B.

In comparison, the Brooker Creek fire, as stated in the case study, was uncontrolled, then contained and treated as a controlled burn with a "let it burn" strategy. As a result of the late planning and emergency implementation of strategies there was a significant increase in staffing personnel, over utilization of equipment and resources as compared to a controlled burn. The cost and duration of suppressing this fire were greatly increased. The fire lasted four days, with over 37 hours of suppression activity, with costs exceeding \$12,000.

Strategies and Tactics

The first strategic objective in fighting wildfires and the most crucial is - the safety of citizens and firefighters. Next comes property, usually structures and major improvements. "With wildland pre-suppression planning, we can attack the fire aggressively, yet safely, and increase our chances of catching 'the Big One' while it's still small" (Bisbee, 1993, p. 48).

An analysis of the fire history of the Brooker Creek Preserve indicates an aggressive attack strategy employed during the years 1991 - 1996. History indicates that there were three fires

that lasted two days each with the longest time of involvement just over five hours. All other fires have an average time of involvement of 1.25 hours. See APPENDIX C for these details.

Other goals, such as minimizing environmental damage to areas, should be added to the strategic planning. Beginning in 1997 fire suppression agencies adopted the "let it burn" policy. This was evidenced by the fact that there were six fires in 1997. The five fires through the summer of 1997 had an average time of involvement of four hours. The fire described in the case study lasted four days with 37 hours of involvement. Obviously, the "let it burn" policy requires more time of involvement. The "let it burn" policy is new and still not fully accepted by all fire service personnel.

There are differing thoughts about the policy. Some want to fight/suppress all fires, while others wish to let nature take her course and let all naturally occurring fires burn unless there is a threat to lives or property. Fire ecologists support prescribed burning and prescribed natural fires as a method of achieving fire safety and healthy wildland and forest ecosystems (Winston, 1996, p. 36).

Sometimes, no matter what you do, it will not be enough. Sometimes conditions that are beyond the firefighters' control will not allow them to extinguish the fire. The best action may be to take no action at all. "As difficult as it is for firefighters to just let fires burn, it may be better to do so until there is a change in conditions that are causing the fire to burn with such intensity that an attempt to control the fire may not be safe" (Queen, 1994, p. 79). It may be advisable to find a location that has less fuels that will cause the fire to slow down, or wait until there is a change in the weather and time of

day.

The time of day has a definite effect on basic fire behavior conditions. Temperature, wind fuel moisture and moisture in the air continually change as the day wears on. "The wildland firefighters' working day usually starts around 10 AM, when the most dramatic change starts to take place. Another shift in conditions occurs about 6 p.m., when the atmosphere starts to cool down, and the moisture content starts to rise" (Queen, 1994, p. 69).

When conditions are on the side of the firefighters it allows them to go in and use a direct attack to extinguish the fire on their terms.

Technologies

For years firefighters traditionally fought wildland fires with only water. New technologies have improved water's ability to penetrate fuels and give it better surface tension to avoid the run off from vertical surfaces due to gravity. Two technologies used in attack tactics are Class A foam applications and a newer technology called BARRICADE. "Class A Foam, initially described as a fire suppression agent, was patented in England around 1877" (McKenzie and Raybould, 1990, p. 16). The class A foam technology of today is different from that of the past and has seen improvements because of the work in wildland fire control. The most important technological aspect is how class A foam enhances water's capability to control fires. "An active portion of the concentrate in Class A foam is a surfactant. The surfactant, a long-chain molecule, has one end that is attracted to water, while the other is repelled by water and attracted to hydrocarbons" (Koehler, 1993). This results in reduced water surface tension and increases the ability to penetrate fuels on contact. "Foam has no long-term fire-retardant

properties. It relies on water within it for suppression capabilities, for it is the water that extinguishes the fire" (Colletti, 1992).

BARRICADE gel is a new technology that out-performs foam.

Foaming agents are mixed with air and water to produce air bubbles. But air bubbles burst when the temperatures climb to about 170 degrees. Barricade uses a hydration process rather than aeration - the polymers are like dry sponges and soak up water. What you get is millions of tiny drops of water surrounded by polymer shells, stacked like AFFF or Class A foams - except that the drops are water- filled instead of air filled" (Anderson, 1997, p. 42).

This greatly increases Barricade's thermal protection qualities. The concentrate mixed with water produces a viscous solution like slime that will adhere to trees, shrubs and any other combustible, greatly reducing water run off. "The hydrated polymer is almost identical in appearance to petroleum jelly. The slime protects combustibles from radiated heat, flying brands, and direct flame impingements" (Bartlett, 1996, p. 49). This makes it a much more effective tool in the direct attack tactic of wildland firefighting.

As we enter the age of computers, facts, research, and technologies are becoming critical components of problem solving for the wildland fire services. "The geographic imaging systems (GIS) stores and uses information about specific map features and their characteristics, then relates the features to one another in various ways" (Close, 1993, p. 20). This system contains several databases that are linked together allowing the user to store information such as roads, land ownership, population density, fire protection jurisdictions, and vegetation. Through an overlay process different areas of

information can be analyzed at the same time in a way that would be difficult with conventional methods.

"This tells us several things: where the fires are likely to be, how difficult they might be to control, what potential dangers are to people, where fuel modifications are needed and the expected threat to structures" (Close, 1993, p. 21).

The BEHAVE fire behavior predictions and fuel modeling system is a set of interactive, (user friendly) computer programs for estimating wildland fire potential under various fuels, weather and topographic situations. Since 1984, BEHAVE has been used by land managers for a variety of fire management needs. "BEHAVE is ideally suited to real time predictions of the behavior of wildfire, determining appropriate suppression actions, predicting the growth of a wildland fire, and prescribed fire planning" (Andrews and Chase, 1986, p. 1). With the BEHAVE model and the GIS map layering several complex layers of information are reduced to a single, dynamic map that displays potential fire behavior under a variety of conditions.

The findings and observations of those in the literature review convinced this author that the fire service can and must improve its planning of wildland fires.

PROCEDURES

Research Methodology

The methodology for this applied research project included two types of research: historical and action. The desired outcome of this research was to develop a pre-fire plan for use by a unified command during a fire on the BCP. Historical research was conducted for the literature review to understand the goals and mission of the BCP and why it was created. This information was obtained from the director of BCP, Dr. Craig Huegel, and the Assistant Director, Mark Dosmann. They explained that the aggressive firefighting tactics of the past caused an imbalance in the ecology, and produced a dangerous buildup of vegetation. The prescribed burn program as outlined in the Fire Management Plan was discussed in order to facilitate the use of fire in the preserve to reestablish the natural balance in the ecology.

Fire history of the BCP from 1991 - 1997 was retrieved from the computer information stored at East Lake Fire and Rescue in order to review the tactical strategies employed by fire suppression. An interview with Dick Fletcher, Chief Meteorologist of WTSP TV, a local news station, added technical information about weather and weather history, with a detailed explanation of atmospheric stability and temperature inversions and their role in smoke management. The data gathered was based on a fire case study and on the experience and advice of fire officers, foresters, and the staff of the BCP. All the resources used in BCP fire were combined into a single report to calculate the cost of fighting a wild fire. A cost analysis of a prescribed fire was obtained from the Boyd Hill Nature Park. The library at ELF&R, and the Learning Resource Center at the National Fire Academy, were the

sources of technical and background information concerning wildland areas.

The applied research project was action research in that the information gathered was to be implemented in the form of an incident action plan to be used at fires on the BCP. Mark Dossmann ran a BEHAVE, computerized wildland fuel model program to calculate burn conditions for the preserve's eight fuel models. Maps for the preserve were surveyed to locate existing roads and natural fire breaks for use in future fires (See Map 3, APPENDIX D). DOF Area Supervisor, Michael Perry, reviewed the incident action plan from September 17 - 20, 1997 and made recommendations to be included in the IAP in the future. A phone survey was conducted with fire officials throughout the State of Florida. The departments contacted had similar wildland areas adjacent to their jurisdiction and are protected by the Florida Division of Forestry Fire Management Plan.

As a result of this applied research project a pre-fire plan was developed in the form of an incident action plan. Adoption of this plan requires review and approval by top management of East Lake Fire and Rescue, Oldsmar Fire Department, the Florida Division of Forestry, and the staff of the Brooker Creek Preserve.

Limitations

One goal of this project was to reduce the costs of fire suppression and improve the ecology of the BCP. However, the implementation of this plan will be contingent upon weather conditions and forecasts. Unfavorable wind conditions, and a stable atmosphere would make this plan unfeasible.

Generally, this plan will not be implemented during initial attack operations, as fires are least expensive to extinguish when small. Rather, this plan will be considered as an option when it

becomes evident that initial attack crews will not be able to contain the fire.

The use of Class A foam is limited due to budgetary restraints and lack of the appropriate equipment in the proper application of the foam.

This plan is also limited to remote wilderness areas of the BCP. All fires must be fought aggressively when located in areas that immediately threaten residential developments.

DEFINITION OF TERMS

BCP	Brooker Creek Preserve
BEHAVE	A computerized fire model that calculates the burn behavior of various vegetations using inputs including fuel moisture, weather conditions, an topography.
Dispersion	The removal of pollutants from the atmosphere over a given area; or the distribution of a given quantity of pollutant throughout a volume of atmosphere.
ELF&R	East Lake Fire and Rescue
FDOF	Florida Division of Forestry
Fire Ecology	Environmental theory that recognizes the need of periodic fires to maintain ecological balance in specific vegetation communities.
FMP	Fire Management Plan is a plan that is to be used as a guide for fire management on the Brooker Creek Preserve.
IAP	Incident Action Plan - a plan of action compiled from the following Incident Command System courses:

Incident Objectives (ICS 202)

Organizational List (ICS 203)

Division Assignment List (ICS 204)

Communication Plan (ICS 205)

Medical Plan (ICS 206)

Incident Status Summary (ICS 209)

Air Operations Summary (ICS 220)

Demobilization Checkout (ICS 221)

Incident Weather Forecast

Incident Maps

Inversion An increase of temperature with height in the atmosphere. Vertical motion in the atmosphere is inhibited allowing for pollution buildup. A normal atmosphere has temperature decreasing with height.

Mixing Height The height at which relatively vigorous mixing of the atmosphere occurs.

OFD Oldsmar Fire Department

Particulates Any liquid or solid particles temporarily suspended in the atmosphere.

RESULTS

There are two main goals which the author undertook to accomplish: one is to answer the research questions as outlined in the introduction; the second is to identify components of the Incident Command System to aid in the development of a pre-fire plan for the Brooker Creek Preserve.

The answers to the research questions are as follows:

1. What is the difference between a Fire Management Plan and a Pre-fire Plan?

A Fire Management Plan is proactive in that the use of fire is restored to wildland areas in a constructive manner in order to reduce dangerous levels of fuels, and to enhance the ecology of the area. Fire Management Plans are detailed written plans for wildland areas that take into considerations conditions before a fire is set under specific plan of action for particular results and intended outcomes. The Brooker Creek Preserve is the responsibility of professional managers for that specific wildland area, with the obligation that includes the needs of the plant communities and wildlife within that property.

A Pre-fire Plan is reactive, in that a fire has to occur for that plan to be used. "The elements of a Pre-fire Plan pinpoint particular features needed to combat a fire. Ordinarily, the plan should identify all features of an occupancy that might effect firefighting tactics, especially those that are unusual or dangerous" (Clark, 1991, p. 292). According to interviews by the researcher, a majority of fire departments responsible for the protection of wildland areas do not have a pre-fire plan. This is evidenced by the fact that the four departments adjacent to the BCP currently do not have a pre-fire plan in effect. The next largest wildland area in Pinellas County is the Boyd Hill Nature Park which is a

250 acre wildland area protected by the St. Petersburg Fire Department that does not have a pre-fire plan for that area. The Munson Fire Department adjacent to the Blackwater Forest in North Florida does not have a pre-fire plan.. There is no pre-fire plan for the Ocala National Forest in Central Florida, under the jurisdiction of the Ocala Fire Department and the Marion County Fire & Rescue. The Metro Dade Fire Department does not have a pre-fire plan for the Everglades National Forest in South Florida. More information concerning these interviews can be found in Appendix E.

One of the goals of the researcher was to find a pre-fire plan already in existence for an established wildland area as large as the Ocala National Forest, or the Florida Everglades. An unexpected finding of the interviews was the fact that the fire departments with the responsibility of protecting these areas do not have a formal written pre-fire plan, but have adopted the Fire Management Plans of the property management authority for that area.

2. What effect did weather play on the Brooker Creek fire?

The southeast is the lightning capital of North America, with 78 days of thunderstorms in 1997. The Brooker Creek fire was investigated, and was found to be caused by lightning which created two separate fires.

The smoke from the fire was the greatest concern of the community. The average smoke dispersion level was 23 with a stable atmosphere. Stable air tends to restrict convection column development. The products of combustion are held in the lower layer of the atmosphere. Visibility was reduced because of the accumulation of smoke in the area due to the stable atmosphere. The fire

burned day and night for four days. As the earth cools each night, the air near the ground is cooled more than the air above, forming a stable layer. Because this cold air is denser, it drains into low lying areas carrying with it smoke from smoldering stumps, branches and other debris, which greatly effected the surrounding communities of the Brooker Creek Preserve.

Mother Nature started the fire with lightning, and ended it with another storm that dropped 7.5 inches of rain. This was the wettest year in the history of the Brooker Creek Preserve with 67.7 total inches of rain.

3. What is prescribed burning, and what are the benefits and risks?

Prescribed burning is a management tool used by wildland managers for the care and maintenance of their wildland areas. It is the controlled application of fire to a specific area under specific conditions to produce specific results. Through the use of the controlled application of fire the goal of the Fire Management Plan of the Brooker Creek Preserve to restore fire to the preserve for the conservation and restoration of wildlife habitats native to the County and to West Central Florida can be achieved. In addition, controlled burning will reduce hazardous fuel loads that have been building over the decades because of the former aggressive fire suppression. This will decrease the intensity of a fire in the future if one breaks out in the same area that was treated with prescribed fire.

The risks of controlled burning include spread of the fire beyond predetermined boundaries of the containment area resulting in an uncontrolled wildfire. Unexpected changes in weather or atmospheric stability can have a negative effect on the smoke management aspect of a controlled burn resulting in poor smoke dispersion. The smoke from any fire on the Preserve could cause community

concern which can result in alarm and numerous calls to the 911 dispatch center.

4. What is the cost of combating fires in the wildland?

The cost of wildland fires has increased due to the "let it burn" strategy because the time of involvement is four times greater than with the aggressive attack strategy of the previous years. The additional cost of the time of involvement necessitates the hiring of additional overtime personnel to staff apparatus to run other emergency calls within the jurisdiction. Add to that the costs of food, fuel, and other expenditures related to prolonged operations. The implementation of the "let it burn" policy has meant an increase in budgetary expenditures of the fire service.

The Brooker Creek Preserve has put in place a controlled burn plan that is self-sufficient, and doesn't require the use of outside resources. The plan only relies on the fire service for controlled burns that become out of control. There will be no cost to the fire service for their controlled burn program.

5. What tactics, strategies and technologies are available to combat wildland fire?

Firefighting tactics and strategies will be better utilized with the applications of Class A foam and BARRICADE. Class A foam gives water better adhesive qualities which reduces water runoff, giving brush units more effective means of applying water in the direct or indirect attack of wildland fires.

Real world testing of BARRICADE Firefighting gel:

A 3500 degree torch was held to a pair of 6' Christmas trees. One was coated with BARRICADE, and the other was not. The latter tree was fully involved within 15 seconds of application of the torch. The one coated with BARRICADE had no damage after 60 seconds. A similar test was used on two sheets of 4 x 8 plywood. Again, a 3500 degree torch was applied to the untreated piece of plywood

which received major damage after two minutes of application. The treated sheet of plywood received no damage after 5 minutes of application. A test on the Brooker Creek Preserve was performed with BARRICADE. A head fire was produced in a stand of 6 feet high palmettos. BARRICADE was applied to one side of a fire lane, and stopped the head fire from crossing the boundary causing it to remain within the containment area.

An unexpected benefit of the research for this project revealed the new technology of this firefighting gel called BARRICADE. As a result of this, a contact was made with the representative for BARRICADE in the State of Florida, John Bartlett, who was able to set up the demonstration described above. If it was approved for purchase this would be a very useful product in fighting future fires on the Brooker Creek Preserve.

A system of computer database maps, called the Geographic Imaging Systems, or GIS, is in the process of being implemented on the Brooker Creek Preserve. Due to the newly established management of the Preserve, the GIS maps are still in the process of being developed. As of this date two map overlays have been finished: the management areas, and the fire grid. The staff of the Preserve predict that by the end of the year 1998 they will have a completely detailed set of maps of the Brooker Creek Preserve's GIS system to be utilized including all the fire breaks, roads, burn areas, endangered wet lands, species, and plant communities.

The BEHAVE fuel modeling system is another computer technology that can be used to predict fire behavior. BEHAVE calculations were analyzed for the eight fuel models on the Brooker Creek Preserve with the following results: (APPENDIX F)

Grass Groups

Fuel Models 1 & 3

Fires are surface fires that move rapidly and spread under the influence of wind.

The midflame wind speed of 2 - 16 mph will produce flame lengths of 1.5 - 7 feet. Hand crews can fight fires up to 2 foot flame lengths. Motorized equipment can be used up to 6 foot flame lengths. Anything over that should be left to burn until the flame length diminishes to a safer flame length.

Shrub Groups

Fuel Models 4, 6, & 7

These are fast spreading fires. Live and dead fine, woody materials significantly contribute to the fire intensity. Fire carries through the scrub layers where the foliage is more flammable, but this requires moderate winds, greater than 8 mph at mid-flame length. Flame length of a head fire ranges from 5 - 15 feet in length. Hand crews should not be permitted in this type of fuel. Motorized equipment can be effective in low wind speeds and flame lengths up to 8 feet.

Timber Group

Fuel Models 8 & 9

Fires in these fuel models are slow burning ground fires with low flame lengths. Although fires may encounter an occasional heavy fuel concentration that can flare up. Head fire flame lengths range from 2 - 8 feet. Hand crews can be effective up to 2 - 4 feet.

Motorized equipment can be utilized up to 6 - 8 foot. flame lengths.

Historical fire weather and fuel condition data is also included in this section. The average

minimum and maximum air temperature ranges from 40 - 100 degrees. The relative humidity ranges from 25 - 95 percent, with wind speed at 20 foot level of 5 - 20 mph, and mid-flame windspeeds of 2 - 16 mph. One hour fuel moisture ranges from 2 - 16 percent; ten hour fuel moisture ranges from 10 - 17 percent: 100 hour fuel moisture ranges from 10 - 17 percent.

The components of the Incident Command System were studied and analyzed. Ten of these components were formulated into an Incident Action Plan (IAP) to be used in fighting future fires at the Brooker Creek Preserve. These are listed in Appendix G.

The objective of the IAP is to reduce the loss of life and property damage through pre-incident planning. Considerations for pre-incident planning processes are: Identify wildland/urban interface where potential for wildland fires is significant and values at risk are high. The plan utilizes maps for an overview of areas and identifies any obvious hazards that need immediate attention. A complete ground inspection was done utilizing maps to evaluate access with equipment to likely staging areas, evacuation routes, and conditions of roads and locations of utility lines to be used as fire breaks (Map 3). The plan utilizes a process to document pre-fire, fire, and post-fire strategies, including BEHAVE calculations that better manage the fuels to predict strategies. In addition, weather forecasting will predict the best strategies to be used. It takes into consideration radio communication for incident planning, air operations, and other multi-agency equipment used at an emergency. To insure the safety of the community and the firefighters, it includes an emergency medical procedure.

DISCUSSION

The aggressive suppression in the past of wildland fires must now be replaced by the "let it burn" strategies. The Brooker Creek Preserve must be treated as a valuable property, and protected in the same way that the fire service protects other improved properties. Since the Preserve is now under the management of the Pinellas County's Environmental Control, the goals of the management plan need to be reevaluated by the fire service. Just as in fighting structural fires, the goal of fire service is: Protect life and property. The Preserve is now a valuable piece of property to the Pinellas County citizens, so there must be the highest consideration taken to avoid unnecessary damage to the ecology of the Preserve. In order to protect this valuable wildland property, a pre-fire plan was needed.

To the surprise of the researcher, the phone survey that was conducted in order to find an existing pre-fire plan for a wildland area, found that one did not exist. The complexity of wildland management was left up to the property managers of the property. These managers are trained and many have doctorates in environmental management. Structural firefighters are trained in fire suppression systems, building constructions, fire code requirements, and other features that are built into structures. They are not educated in the complexities of the environment and weather patterns, and so are not trained to do a pre-fire plans for these areas. They rely on the property managers to formulate this technical information which is normally found in fire management plans that surrounding fire service communities adopt.

Through the decades, former aggressive strategies left the Brooker Creek Preserve

with dangerously high levels of vegetative fuels. Programs similar to "Smokey Bear" created the understanding that fire is bad for forests: forests are not intended to burn. Whenever a fire was spotted, it was quickly and aggressively suppressed, using whatever means necessary, even destroying valuable plant communities and damaging the ecology. Through the education process of this research, it is now believed that fire is a benefit to the ecology of the Preserve. The adoption of the "let it burn" philosophy has proven to be a benefit in fuel reduction. The fire service that has the responsibility of protecting a wildland area like the Brooker Creek Preserve needs to have a pre-fire plan in place that is proactive utilizing the benefits of a naturally occurring fire. Development of an Incident Action Plan allows the fire service to incorporate the goals of the Brooker Creek Preserve's Fire Management Plan.

An additional benefit of the research was to discover new technologies that are in the process of being further evaluated for use by the East Lake Fire & Rescue on the Brooker Creek Preserve. The use of Class A foam and the utilization of BARRICADE will be an improvement in the tactics and strategies in combating wildland fires. The continued upgrading of the maps utilizing the GIS mapping system that is in place with the addition of BEHAVE calculations will be beneficial in the IAP.

The IAP has the potential to decrease the cost of fire fighting if used correctly. The costs will be reduced in the "let it burn" philosophy in that there will not be overutilization of equipment and excess staffing levels. The IAP will be able to determine the areas that are supposed to burn if under the correct weather conditions. They will be treated as a prescribed fire with limited resources, and allowed to burn naturally. The tactics and strategies at the present time are still too expensive because this policy has not yet been completely adopted. With complete adoption of the IAP by the

top management of the fire services that are involved, there should be reduced cost, as well as improvements in the ecology, and incorporation of the goals of the Brooker Creek Preserve.

RECOMMENDATIONS

It is recommended that the Incident Action Plan (IAP), be implemented on future Brooker Creek Preserve fires that can not be suppressed with initial resources. The IAP will evaluate the environmental effects of the fire ecology. Strategies and tactics will be developed to minimize the costs of suppression.

This project recommends future fires on the Brooker Creek Preserve be suppressed as if they were planned prescribed burns until preferred weather conditions are evaluated:

1. Preferred wind speed at eye level is 1 - 3 mph.
2. Preferred 20 foot wind speeds are of 6 mph, and a maximum of 20 mph.
3. Preferred humidity is 30 - 55%.
4. Preferred fine-fuel moisture is between 10 - 20%.
5. Preferred atmospheric stability of slightly unstable to neutral.
6. Preferred mixing height of 1700 - 6500 feet above ground.
7. Preferred transport winds 9 - 20 mph.
- 8 Preferred dispersion index of 61 - 100.

It is recommended that East Lake Fire & Rescue use and purchase the appropriate Class A foam systems for brush apparatus. In addition, it is recommended that the Brooker Creek Preserve

purchase BARRICADE to be used to control fire breaks and fire lanes for future prescribed burns and for wild fires. It is also recommended that a description of this plan be included within the pre-fire plan reference binder used by East Lake Fire & Rescue. This plan will require renewal every year, or as conditions of future fires change.

It is recommended that the official approval of this plan be obtained from top management of East Lake Fire & Rescue, Oldsmar Fire Department, the Florida Division of Forestry, and the staff of the Brooker Creek Preserve.

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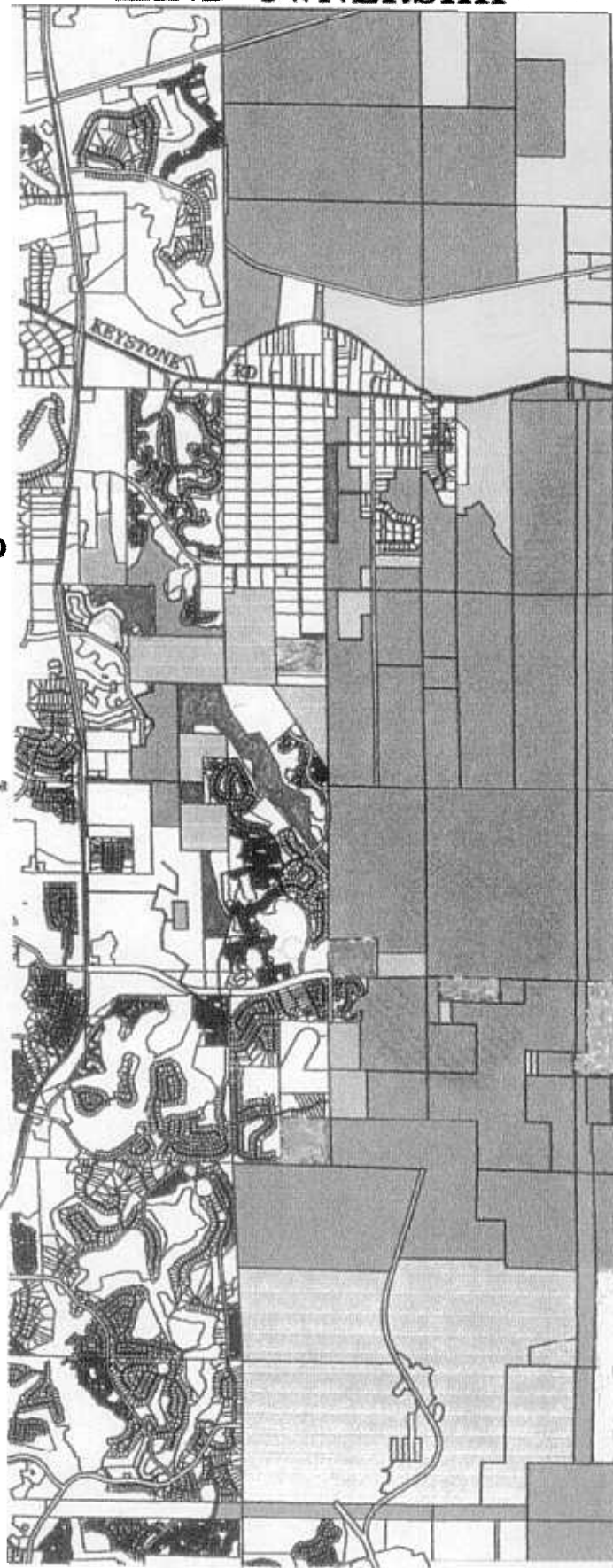
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BROOKER CREEK PRESERVE LAND OWNERSHIP

MAP LEGEND

-  County
-  Eldridge-Wilde
-  SWFWMD
-  Florida Power
-  P2000 - 1988
-  P2000 Purchased
-  P2000 - 1984



GIS

BROOKER CREEK PRESERVE FIRE DEPARTMENT GRID NETWORK



